

significant impact on the volume of dilute exhaust passing through the CVS. The systems shall also comply with the following requirements that apply to the design of the systems, not to individual tests:

(i) The methanol system shall be designed such that if a test motorcycle continuously emitted the maximum allowable level of methanol (based on all applicable standards) the measured concentration in the primary impinger would exceed either 25 mg/l or a concentration equal to 25 times the limit of detection for the GC analyzer.

(ii) The formaldehyde system shall be designed such that if a test motorcycle continuously emitted formaldehyde at a rate equal to twenty percent of the maximum allowable level of THCE (i.e., 1.0 g/km for a 5.0 g/km standard), or the maximum formaldehyde level allowed by a specific formaldehyde standard, whichever is less, the concentration of formaldehyde in the DNPH solution of the primary impinger, or solution resulting from the extraction of the DNPH cartridge, shall exceed either 2.5 mg/l or a concentration equal to 25 times the limit of detection for the HPLC analyzer.

(iii) The methanol and formaldehyde systems shall be designed such that the primary impinger collects at least 90 percent of the analyte in the samples. The remaining analyte shall be collected by the secondary impinger. This requirement does not apply to dilution air samples, since they do not require secondary impingers, or to samples in which the concentrations approach the limit of detection.

(d) *Component description, CFV-EFC- CVS.* The CVS sample system is identical to the system described in paragraph (c) of this section, plus includes a means of electronically measuring the CVS flow rate, and electronic mass

flow controllers for the methanol and formaldehyde sample lines, and separate flow meters to totalize sample flow volumes (optional). The EFC sample system shall conform to all of the requirements listed in paragraph (c) of this section, except that the methanol and formaldehyde samples may both be drawn from a single static probe. It also must comply with the following additional requirements:

(1) The ratio of the CVS flow rate to the sample flow rate shall not deviate from the ratio at the start of the test by more than  $\pm 5$  percent. (The volumetric sample flow rate shall be varied inversely with the square root of the bulk stream temperature.)

(2) Flow totalizers for methanol and/or formaldehyde samples shall have an accuracy of  $\pm 2$  percent. Total sample volumes may be obtained from the flow controllers, with the advance approval of the administrator, provided that the controllers can be shown to have an accuracy of  $\pm 2$  percent.

[54 FR 14539, Apr. 11, 1989, as amended at 59 FR 48512, Sept. 21, 1994; 60 FR 34351, June 30, 1995]

#### § 86.511-90 Exhaust gas analytical system.

(a) *Schematic drawings.* Figure F90-3 is a schematic drawing of the exhaust gas analytical system for analysis of hydrocarbons (HC) (hydrocarbons plus methanol in the case of methanol-fueled motorcycles), carbon monoxide (CO), carbon dioxide (CO<sub>2</sub>), and oxides of nitrogen (NO<sub>x</sub>). Since various configurations can produce accurate results, exact conformance with the drawing is not required. Additional components such as instruments, valves, solenoids, pumps and switches may be used to provide additional information and coordinate the functions of the component systems

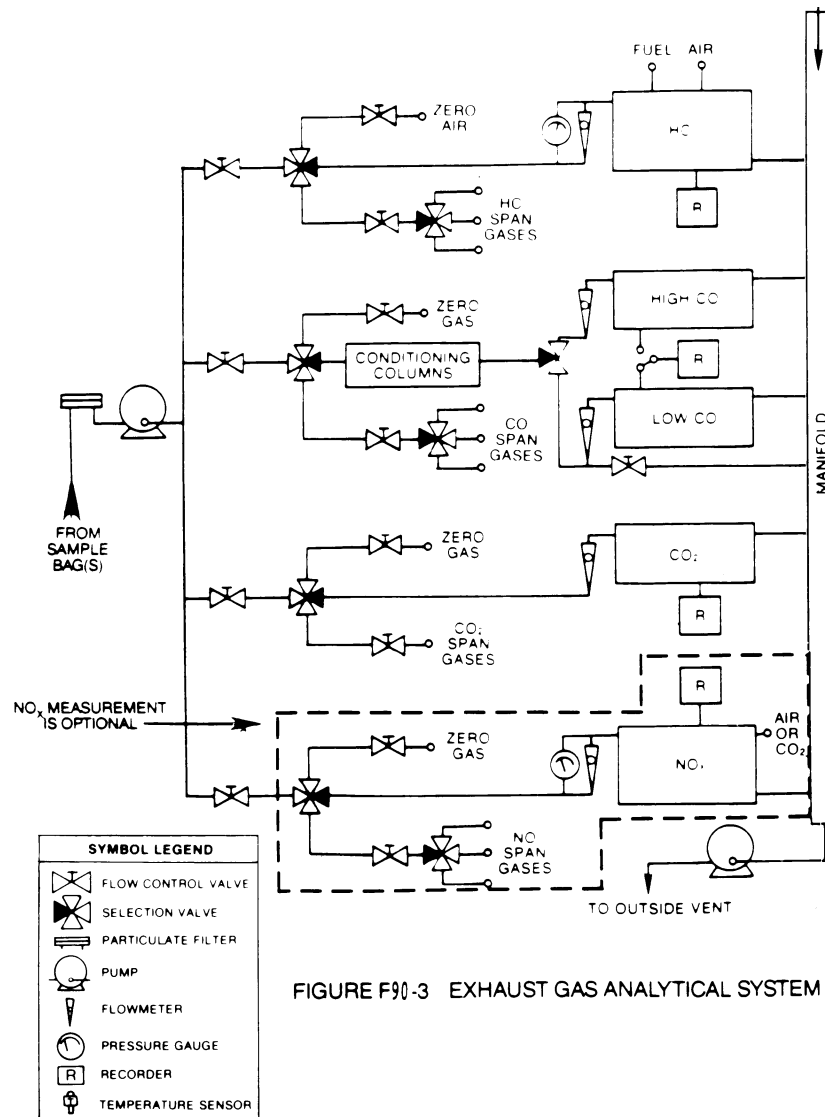


FIGURE F90-3 EXHAUST GAS ANALYTICAL SYSTEM

(b) *Major component description.* The exhaust gas analytical system for HC, CO and CO<sub>2</sub>, Figure F90-3, consists of a flame ionization detector (FID) (heated (235°±15 °C (113°±8 °C))) for methanol-fueled vehicles) for the determination of hydrocarbons, nondispersive infrared analyzers (NDIR) for the determination of carbon monoxide and carbon dioxide

and, if oxides of nitrogen are measured, a chemiluminescence analyzer (CL) for the determination of oxides of nitrogen. The analytical system for methanol consists of a gas chromatograph (GC) equipped with a flame ionization detector. The analysis for formaldehyde is performed using high pressure liquid chromatography (HPLC) of 2,4-

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dinitrophenylhydrazine (DNPH) derivatives using ultraviolet (UV) detection. The exhaust gas analytical system shall conform to the following requirements:

(1) The CL requires that the nitrogen dioxide present in the sample be converted to nitric oxide before analysis. Other types of analyzers may be used if shown to yield equivalent results and if approved in advance by the Administrator.

(2) The carbon monoxide (CO) NDIR analyzer may require a sample conditioning column containing  $\text{CaSO}_4$ , or indicating silica gel to remove water vapor and containing ascarite to remove carbon dioxide from the CO analysis stream.

(i) If CO instruments which are essentially free of  $\text{CO}_2$  and water vapor interference are used, the use of the conditioning column may be deleted, see §§ 86.522 and 86.544.

(ii) A CO instrument will be considered to be essentially free of  $\text{CO}_2$  and

water vapor interference if its response to a mixture of 3 percent  $\text{CO}_2$  in  $\text{N}_2$  which has been bubbled through water at room temperature produces an equivalent CO response, as measured on the most sensitive CO range, which is less than 1 percent of full scale CO concentration on ranges above 300 ppm full scale or less than 3 ppm on ranges below 300 ppm full scale; see § 86.522.

(c) *Other analyzers and equipment.* Other types of analyzers and equipment may be used if shown to yield equivalent results and if approved in advance by the Administrator.

[54 FR 14544, Apr. 11, 1989]

### § 86.513 Fuel and engine lubricant specifications.

(a) *Gasoline.* (1) Gasoline meeting the following specifications, or substantially equivalent specifications approved by the Administrator, must be used for exhaust and evaporative emission testing:

TABLE 1 OF § 86.513—GASOLINE TEST FUEL SPECIFICATIONS

Item	Value	Procedure <sup>1</sup>
Distillation Range:		
1. Initial boiling point, °C .....	23.9—35.0 <sup>2</sup> .....	ASTM D86
2. 10% point, °C .....	48.9—57.2 .....	
3. 50% point, °C .....	93.3—110.0 .....	
4. 90% point, °C .....	114.8—162.8 .....	
5. End point, °C .....	212.8 maximum .....	
Hydrocarbon composition:		
1. Olefins, volume % .....	10 maximum .....	ASTM D1319
2. Aromatics, volume % .....	35 maximum .....	
3. Saturates .....	Remainder .....	
Lead (organic), g/liter .....	0.013 maximum .....	ASTM D3237
Phosphorous, g/liter .....	0.0013 maximum .....	ASTM D3231
Sulfur, weight % .....	0.008 maximum .....	ASTM D2622
Dry Vapor Pressure Equivalent (DVPE), kPa .....	55.2 to 63.4 <sup>3</sup> .....	ASTM D5191

<sup>1</sup> ASTM procedures are incorporated by reference in § 86.1.

<sup>2</sup> For testing at altitudes above 1,219 m, the specified initial boiling point range is (23.9 to 40.6) °C.

<sup>3</sup> For testing at altitudes above 1,219 m, the specified volatility range is 52 to 55 kPa. Calculate dry vapor pressure equivalent, DVPE, based on the measured total vapor pressure,  $p_T$ , using the following equation:  $DVPE$  (kPa) =  $0.956 \cdot p_T - 2.39$  (or  $DVPE$  (psi) =  $0.956 \cdot p_T - 0.347$ ). DVPE is intended to be equivalent to Reid Vapor Pressure using a different test method.

(2) The following specifications apply for fuels used during service accumulation for certification:

(i) Unleaded gasoline and engine lubricants representative of commercial fuels and engine lubricants which will be generally available through retail outlets shall be used in service accumulation.

(ii) The octane rating of the gasoline used shall be no higher than 4.0 Research octane numbers above the min-

imum recommended by the manufacturer.

(iii) The Reid Vapor Pressure of the gasoline used shall be characteristic of commercial gasoline fuel during the season in which the service accumulation takes place.

(b) *Methanol fuel.* (1) Methanol fuel used for exhaust and evaporative emission testing and in service accumulation of methanol-fueled motorcycles